

Final report for the Wengen Workshop on Global Change Research on 'Climate Change and Desertification'

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with input from Lecturers, Chairpersons, Rapporteurs and Participants*

The 13th edition of the annual Wengen Workshops on Global Change Research took place in Wengen, Switzerland, from 10 to 13 September 2007. It assembled some 50 scientists and experts in various fields, from climate to policy making and from remote sensing to livestock management. The goals of the workshop were to step back and review (1) where we are and what we have learned about desertification processes over the last three decades, (2) the current state of the art in this and related fields (monitoring, modelling, integration of natural and social sciences, historical background, etc), and (3) where we are heading, given the high likelihood of significant climate changes in the coming decades, with a view to recommend priorities for further research and monitoring activities in this broad interdisciplinary field. The participants also discussed the best ways to convey the main scientific findings to policy makers and actors on the ground, and, more generally, to promote a renewed and revived dialogue between the scientific community and the UNCCD COP.

This event coincided with the 30th anniversary of the holding of the UN Conference on Desertification in Nairobi (UNCOD, September 1977) and took place just over 10 years after the entry into force of the UN Convention to Combat Desertification (UNCCD, December 1996). The web site of the conference is located at <http://www.unige.ch/climate/Workshops/wengen07.html>.

The Scientific Steering Committee (SSC) which oversaw the preparations for the workshop included:

- Mohamed Badraoui, Haut Commissariat aux Eaux et Forêts et à la Lutte contre la Désertification, Rabat, Maroc
- Martin Beniston, University of Geneva, Switzerland
- Andreas Brink, EC Joint Research Centre, Ispra, Italy
- Filippo Giorgi, International Centre for Theoretical Physics, Trieste, Italy
- Joachim Hill, University of Trier, Trier, Germany
- Malcolm Hughes, University of Arizona, Tucson, AZ, USA
- Luca Montanarella, EC Joint Research Centre, Ispra, Italy
- Osvaldo Sala, Brown University, Providence, RI, USA
- Robert (Bob) Scholes, CSIR, Pretoria, South Africa
- Mary Seely, Desert Research Foundation of Namibia (DRFN), Windhoek, Namibia
- David S. G. Thomas, Oxford University, Oxford, United Kingdom
- Michel M. Verstraete, EC Joint Research Centre, Ispra, Italy

Scientific topics covered during the workshop included, inter alia:

- Monitoring: direct and indirect observables, in situ and space-based approaches, with particular attention to quantitative approaches and to assessing their accuracy and reliability
- Modelling: key processes, essential variables, tools and techniques to integrate formal knowledge and measurements
- Thematic issues: overgrazing, soil erosion by wind and water, drought and climate change, salinisation, relations with deforestation and loss of biodiversity, social and economic factors, integration of issues into a holistic view
- Historical perspective and future projections: lessons from paleo-climatic reconstructions, forecasting desertification risks in the context of expected climate changes

The detailed programme of the workshop and a list of participants are appended as Annexes 1 and 2, respectively. Presentations and discussions were organized along 7 successive plenary sessions (without overlap or parallel activities). Some 15 posters were also exhibited and discussed during breaks.

The following is a summary of the main findings of each session, synthesized on the basis of notes received from the respective Chairpersons and Rapporteurs of the respective sessions.

Martin Beniston opened the meeting and welcomed the participants. He described the 'spirit' of the Wengen Global Change seminars and summarized the history of the series, highlighting the diversity and scope of the themes already addressed. He thanked his associates for their contribution to the organization of the workshop.

Michel M. Verstraete thanked the sponsoring and organizing institutions, the Scientific Steering Committee and especially the close collaborators who have worked hard to help organize this event: Andreas Brink, Douglas Cripe, Anthony Lehmann and Luca Montanarella. He outlined the rationale for and aims of the workshop, and made two suggestions: to support the emerging Dryland Development Paradigm (DDP) with an organized Global Dryland Observing System (GDOS) which would complement the existing Global Climate Observing System (GCOS), and to invent a mechanism to provide scientific support to the UN Convention to Combat Desertification (UNCCD). Although the setup and format may be different, such an organization should deliver expert advice with the same level of excellence and depth as the Intergovernmental Panel on Climate Change (IPCC) is providing to the UN Framework Convention on Climate Change (UNFCCC).

Session 1: Desertification – The Policy Context

Chairperson: Michel M. Verstraete

Rapporteur: Stefan Sommer

Guest speakers:

Ann Henderson-Sellers (World Climate Research Programme, WCRP, Geneva, Switzerland) presented an overview of the WCRP and expressed the wish to enhance the relations between this organization and the United Nations Convention to Combat Desertification (UNCCD). She discussed some of the findings of the recently issued 4th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) and called for the active engagement of scientists in concrete actions to mitigate and adapt to climate change.

Gemma Shepherd (United Nations Environment Programme, UNEP, Nairobi, Kenya) presented a statement on behalf of UNEP's Executive Director, Mr. Achim Steiner. She emphasized the need for scientific understanding of the interactions between climate change and desertification to highlight opportunities for synergies among preventive, adaptation and mitigation strategies. She also called for more research on the potential benefits of avoided desertification.

Alexia Massacand (GEO Secretariat, Geneva, Switzerland) described the structure and programme of Group on Earth Observations (GEO) and the Global Earth Observation System of Systems (GEOSS). She identified 9 main 'Societal benefit areas' where GEO intends to be proactive and highlighted some of the activities in the climate and human health areas.

Virginia Puzzolo (Global Monitoring for Environment and Security, GMES, Brussels, Belgium) reviewed the activities of the Global Monitoring for Environment and Security, a joint European Commission and European Space Agency initiative to build an operational Earth observation capacity to provide reliable and sustained information services. She described the overall architecture and infrastructure of this complex initiative, including the planned missions (Sentinel), the planned core and downstream services, as well as the current 'Fast track' services, addressing the needs of land, marine and emergency response.

Emerging Themes:

Understanding and predicting the impact of human activities on climate would be useful in a range of practical applications, including promoting sustainable approaches to land management and mitigating the worse effects of desertification. A key scientific and technical issue in this context is the downscaling of climate models, including seamless linkages between weather and climate prediction systems.

New high-level international initiatives have been launched to put in place and coordinate elements of a global integrated Earth Observation System, incorporating space-borne and in-situ observation networks and services.

New developments and novel ideas:

There was a general consensus on the necessity to promote interdisciplinary research in order to document the complex non-linear dynamics (feedback loops) that define the relations between human activity, ecosystem functioning and the climate, with a clear focus on practical applications.

Another emerging focus concerns the accounting of the benefits to be accrued from mitigation actions, not only for the sustainable development of the concerned areas, but also in terms of their impact on the global climate (e.g., carbon sequestration).

Problem areas and unresolved issues:

In the past, political discussions at the UNCCD Conference of the Parties (COP) have not been sufficiently supported by sound scientific advice. It is understood that the structure, function and membership of the Committee on Science and Technology (CST) are currently being revised, but in any case there will be a need to ensure a much broader involvement of the global scientific community, as has been achieved by the IPCC where some 2500 researchers have contributed to the latest climate change report.

Efforts to establish a comprehensive global Earth Observation system are currently focused on delivering operational products. However, the relevant institutions should pay more attention to promoting research and development activities and ensuring that state of the art algorithms and products are being generated. The reliability and accuracy of the information are critical to support rational actions and policies, and these cannot be guaranteed without sustained research efforts, including for the evaluation of the products through field campaigns and benchmarking exercises.

The scientific community itself should improve and expand its use of integrated, interdisciplinary approaches. Current practices of personnel evaluation, publication policies, and disciplinary attitudes often prevent or hinder the examination of new unconventional ideas or even serious attempts to conduct interdisciplinary projects.

Session 2: Desertification: The World's most desperate environmental problem?

Chairperson: Osvaldo Sala

Rapporteur: Eric Lambin

Guest speakers:

Bob Scholes (Council for Scientific and Industrial Research, CSIR, Pretoria, South Africa) provided an overview of the issue of desertification in Africa, focusing on the provision of ecosystem services and the typical syndromes of failure in drylands. He described some of the specific processes that lead to declines in soil fertility, vegetation productivity and availability of water, and pointed to the existence of 'traps' which tends to prevent development. Using a systems dynamics approach, he showed how land degradation processes such as bush encroachment and nutrient depletion interact with the climate system by affecting the radiation and water surface balances. He described a variety of monitoring systems, both in situ and from space, and underscored the importance of state of the art science in the support of meaningful policy decisions and practical actions in the field.

Mark Stafford Smith (Commonwealth Scientific and Industrial Research Organisation, CSIRO, Canberra, Australia) presented an overview of the recently developed Dryland Development Paradigm (DDP), emphasizing the current shift in attitude from desertification as an unsolvable problem to the sustainable development of drylands. The DDP, described in more details in a book and an article in *Science* (both referenced below), identifies 5 key features of the dryland syndrome (climatic constraints, in particular the scarcity and variability of precipitations, low soil fertility, sparsely distributed populations, remoteness from markets and decision centres, and limited political weight) and proposes 5 principles to address previously intractable issues, emphasizing the need for a better understanding of human-environment systems, the role of slow variables and thresholds, the role of nested, hierarchical systems and the need to capitalize on local environmental knowledge.

Emerging themes:

An interdisciplinary approach is critical to address these issues, in particular to take advantage of new opportunities: Bush encroachment, for instance, can be viewed as affecting the productivity of the land when grazing is the only issue, but as a source of fuel in a larger context.

New developments and novel ideas:

There has been a recent paradigm change in this interdisciplinary field, with a shift in focus from desertification as a form of land degradation or hazard to a more positive attitude towards the improvement of the livelihood of the population concerned and the

promotion of sustainable development of the concerned regions in general. Such an outlook has been outlined in refereed publications¹.

Problem areas and unresolved issues:

Successful management of drylands should consider ecological and socio-economic components as well as their interactions. In addition, dynamics of drylands usually have thresholds in social and ecological realms. Examples of thresholds are economic or ecological "traps" where systems end up because of a combination of bad management with climatic variability. Extraordinary resources would be necessary to get systems out of these traps.

Session 3: Desertification: Complex interactions between people, climate, and the land

Chairperson: Mary Seely

Rapporteur: Alexia Massacand

Guest speakers:

Eric Lambin (Université Catholique de Louvain, Louvain-la-Neuve, Belgium) provided more details on the coupled human-environment subsystem of the DDP. He also discussed approaches to link remote sensing and socio-economic data at the scale of administrative units, pointing out some of the challenges involved in determining the spatial distribution of variables in the absence of clear boundaries or in the case of highly mobile populations. He described some of the statistical methods currently used and preliminary results obtained in a field study near Lagadas, Greece.

Roy Behnke (Odessa Centre, Aberdeen, UK) discussed the regeneration and degeneration of rangeland conditions in post-socialist Central Asia. He contrasted the situations in Kazakhstan and Turkmenistan, where sheep and cattle populations have experienced drastic changes (multiple millions of heads) since the start of the 20th century as a result of shift in State policies, with significant impacts on the local vegetation and the availability of water. Flock size, access to transportation, and land ownership affect the productivity of the land and the long-term sustainability of this economy.

Osvaldo Sala (Brown University, Providence, USA) discussed the spatial and temporal controls of carbon cycling in arid ecosystems. He described the 'inverse texture hypothesis', which explains the observed differences in the relation between precipitations, water holding capacity and net primary production when comparing semi-arid and sub-humid regions. Relying on data from the US and Patagonia, he stressed the importance of time lags in the response of ecosystems and of differentiated responses to

¹ Reynolds, James F. and D. Mark Stafford Smith, Editors (2002) *Global Desertification: Do Humans Cause Deserts?*, Dahlem University Press and Reynolds, J. F. et al. (2007) 'Global Desertification: Building a Science for Dryland Development', *Science*, **316**, No. 5826 (11 May 2007), pp. 847 – 851, DOI: 10.1126/science.1131634.

changes in water availability within functional groups. He then discussed the differences between shrubs and grasses in terms of their access to and use of water at different depths in the soil.

Hong Jiang (University of Hawaii, Honolulu, USA) examined desertification policies and perceptions in China. Key degradation processes include wind and water erosion, freezing and melting as well as salinization and alkalisation, leading to large economic losses. She provided various examples of well-meaning but ill-informed environmental policies imposed by a bureaucracy that largely ignores the local knowledge and conditions in the field, with mostly deleterious effects. The consequence of desertification in one area may become noticeable in remote regions (as is the case with dust storms in Beijing arising from soil erosion in arid zones much further west). In the absence of reliable understanding of the causes and processes involved, such events can lead to inadequate or misguided policies and remedial actions. Similarly, an over-emphasis on short term gains over long-term sustainable development can lead to disaster, especially for the more fragile segments of society.

Steffen Fritz (International Institute for Applied Systems Analysis, IIASA, Laxenburg, Austria) outlined an integrated framework to assess the potential for wheat production in Africa under likely climate change scenarios. Building on a methodology developed for Europe, he showed how the current model could be used to estimate likely agricultural output on a continental scale, provided suitable input data can be provided.

Emerging themes:

The potentially critical importance of Local Ecological Knowledge (LEK) has been demonstrated through various presentations. Policy and decision makers are well-advised to take advantage of this knowledge, both to promote meaningful changes and adaptation, and to ensure acceptance by and the support of the local populations.

New developments and novel ideas:

Land degradation problems are starting to affect the livelihood and economic development of people outside the affected drylands themselves. Dust storms originating in arid zones may have severe health and environmental effects in remote cities, out-migration from poor drylands to the richer urban environments can stress economies and create security risks, for instance.

Problem areas and unresolved issues:

The scientific community should make definite efforts to identify methods to better integrate biophysical and socio-economic variables, and link remote sensing data to human behaviour and decision trends.

Session 4: Climate drivers of change in drylands

Chairperson: Ann Henderson-Sellers

Rapporteur: Nadine Gobron

Guest speakers:

Malcolm Hughes (University of Arizona, Tucson, USA) provided an overview of climate changes and their impact on arid and semi-arid regions. Using the Western US as an example, he described the various types of changes that can be expected as well as actual, documented changes in water balance components during the instrumental record period. He then briefly explained the principles of dendroclimatology and showed the result of analyses over the last few thousand years, hinting at possible connections between observed fluctuations and episodic events such as the El-Niño-Southern Oscillation (ENSO).

Martin Beniston (University of Geneva, Geneva, Switzerland) reviewed the principles of regional climate modelling, including the issues of coupling such a model to global scale climate models and representing the physical processes that define the interactions between terrestrial surfaces and the atmosphere. He underscored the need for quality information on the initial and boundary conditions to guarantee reliable predictions, as well as to the human component of complex processes such as desertification, which include but are much broader than climate change.

Milena Holmgren (Wageningen University, Wageningen, The Netherlands) showed that rainfall variability associated with the El Niño Southern Oscillation (ENSO) can have profound and persistent impacts on the dynamics of arid and semiarid ecosystems. Rainy ENSO events trigger a pulse in plant growth that typically leads to temporary increase in herbivore populations pushing plant biomass back to the original levels. Thus the rainy pulses do not usually transform desertified lands to a permanent more vegetated state. On the other hand, woodland expansion can sometimes be a long lasting result of a wet ENSO event as trees and shrubs can become relatively less sensitive to drought and herbivory pressure when they grow beyond a certain critical size. She tested the hypothesis that rainy ENSO events can enhance tree recruitment in the semiarid ecosystems of Chile and Peru in western South America. Tree-ring studies in natural populations revealed that rainy El Niño episodes can indeed trigger forest regeneration but that large regional differences exist. Field experiments indicate that these differences in tree seedling recruitment can be explained by herbivory pressure and plant growth rate. These results suggest that ENSO events may be used as 'windows of opportunity' to stimulate forest recovery especially when herbivores are controlled at the right moment.

Anton Imeson (University of Amsterdam, Amsterdam, The Netherlands) discussed the relationship between desertification and climate change. Building on the findings collected in the AR4 of the IPCC and on results from transects in various locations, including Spain and Crete, he pointed to a variety of soil degradation processes operating on different spatial and temporal scales.

Alessandra Giannini (International Research Institute for Climate and Society, IRI, Palisades, USA) highlighted the relation between precipitations in the Sahel and sea surface temperature in various oceanic regions. Such teleconnections provide important hints to understand such a complex system, and may provide a way to predict future droughts if and when lags are identified between these signals. She also described results obtained for the 21st century with a range of climate models. According to these recent results, desertification in the Sahel is not due to the human overexploitation of the region but largely to climatic fluctuations. The role of climate variability on a range of time scales should thus be much better studied and understood when drafting development plans for these regions.

Pietro Ceccato (International Research Institute for Climate and Society, IRI, Palisades, USA) followed with a description of IRI activities in the area of human health (in particular malaria) and its dependency on climate variability. Reliable information on climate and environmental variables can be used to predict outbreaks and thus to take preventive action. He also described programmes of locust control, a pest capable of destroying the agricultural production of entire regions.

Emerging themes:

Climate has changed and will continue to change in the foreseeable future, over a wide range of spatial and temporal scales. The relation between climate change and desertification is not easy to characterize because of human adaptation to such changes, as well as a complex web of processes and feedbacks in ecosystems condition responses.

New developments and novel ideas:

Evidence has been presented to support the claim that a major part of the observed variability in plant cover and productivity may be due to climatic fluctuations linked to teleconnections with sea surface temperature (e.g., with the ENSO and other such oscillations). These may offer both an opportunity for useful long-term forecasts and for timing adaptation and restoration efforts.

Problem areas and unresolved issues:

From a scientific point of view, climate models do not represent land surfaces properties with sufficient or even adequate detail to be useful for local predictions or applications. Yet, this is where all impacts, as well as adaptation and mitigation efforts are taking place. On a more technical side, it was found that regional models (or models that can be operated locally) could be very useful to guide actions and development projects at a local scale. The accuracy of such models should be improved, and a better integration with relevant human (social, economic) processes would also greatly increase their usefulness. Another issue that needs attention is how to translate scientific findings and results into a language that can be understood by decision makers.

Session 5: Population drivers of change in drylands

Chairperson: Mark Stafford Smith

Rapporteur: Andreas Brink

Guest speakers:

Mary Seely (Desert Research Foundation of Namibia, Windhoek, Namibia) reviewed the climatic constraints (in particular precipitation variability) and stressed the human factors that constitute the major drawbacks to the development of arid zones: poverty, knowledge gaps and the impact of climate changes in multi-stressed systems. Uncertainty about land reform, lack of investments, limited local disaster risk management and planning, and an overall international focus on mitigation efforts may also hinder local development. She described efforts to communicate with farmers and herders and demonstrated how a community-level monitoring system can be setup and used to help people manage their resources. Reinforcing the adaptive capacity of these communities can reduce their vulnerability to external stresses and increase their resilience.

Ulf Helldén (Lund University, Lund, Sweden) described the DeSurvey modelling approach, using the Stella software. This system makes all assumptions and relations explicit and allows simulations to be run for different types of scenarios. On the basis of these model simulations, he concluded that it is very difficult to generate irreversible desertification in a system where there is a free market and free population mobility, unless serious climate change and/or extremely serious soil erosion creates long term wasteland conditions. He also showed that positive feedback mechanisms may slow down but do not prevent recovery and that population pressure and droughts are the dominant degradation drivers.

Ibrahim Ali Ismail (FAO-SWALIM, Nairobi, Kenya) presented an overview of the FAO-Somalia Water And Land Information Management project. Through a couple of case studies, he showed that land conditions are degrading in Somalia, mostly in the form of loss of vegetation, soil erosion, and decline in soil nutrients, and that settlements and the availability of fixed water points are largely responsible for this trend. Affected areas are being invaded by non-palatable plant species. He also pointed out the difficulty of assessing changes in a country that has lost most of its national historical archives and stressed the importance of remote sensing data for this purpose.

Emerging themes:

The importance of two-way communications between the main players and actors involved has consistently emerged as a recurring theme in these and other discussions. Dedicated organizations or functions may need to be developed to ensure the flow of information between these stakeholders. Affected populations have accumulated local environmental knowledge (LEK) and sometimes develop monitoring systems that are adequate and suitable for both local and larger applications, including use for the evaluation of scientific models, under certain conditions.

New developments and novel ideas:

System models that include both key climate and environment variables, as well as various social, political and economic variables, offer new opportunities to assess the likely impact of proposed policies, rules and regulations. They play a role similar to global climate models in the case of climate impact assessments.

There is a largely untapped potential to involve local communities in the monitoring of the environment, as well as in the development of a comprehensive understanding of the climatic and ecological processes at work. However, recent developments point to new approaches: In Namibia, herders have learned to make systematic observations of the state of their cattle, and this information is collected and transmitted to scientific organizations and policy makers. More generally, international initiatives are starting to emerge to collect environmental data through very large networks of voluntary contributors. These include, for instance, the GLOBE project sponsored by NASA and the US National Science Foundation (<http://www.globe.gov/>), which is a network of primary and secondary schools, or the Degree Confluence Project, which aims at collecting, in a standardized manner, pictures of the environment on a 1 by 1 degree latitude longitude grid (<http://www.confluence.org/>).

Problem areas and unresolved issues:

A question that remains largely unresolved is the issue of evaluating the accuracy, reliability, validity and range of applicability of the local environmental knowledge (LEK), which may be very appropriate locally, but hard to generalize or exploit in different places or at different times, in part because of a lack of standardized protocols and the possibility of personal and social biases.

This issue is by no means confined to LEK, but concerns scientific disciplines as well: Divergences and differences in definitions and perceptions of desertification continue to muddle the field, with the consequence that widely applicable and agreed-upon measurement protocols and monitoring programmes may be difficult to put in place.

Session 6: Monitoring changes in dry lands

Chairperson: Alessandra Giannini

Rapporteur: Virginia Puzzolo

Guest speakers:

Presentations in this session were of two kinds. Gobron and Govaerts discussed remote sensing of soil properties, respectively FAPAR (Fraction of Absorbed Photosynthetically Active Radiation) and albedo. Hill and Roeder combined the use of remote sensing techniques and local surveys to discuss assessments of land degradation, causes and solutions in Euro-Mediterranean drylands.

Joachim Hill (University of Trier, Trier, Germany) presented the first results of DeSurvey-IP (<http://www.desurvey.net/>), a project funded by the European Commission under Framework Programme 6 which combines remote (e.g. rain use efficiency) and in-situ measurements of biophysical and socio-economic indicators in the assessment of land degradation processes. He reviewed the concept of 'syndromes', and applied it to the context of desertification in the European Mediterranean. He presented a quantitative analysis that combined consideration of trends with changes in the timing and magnitude of the annual cycle of vegetation cover to classify land degradation types. Land abandonment together with overexploitation resulted to be the main factor of land degradation in the European Mediterranean region.

Nadine Gobron (Joint Research Centre, JRC, Ispra, Italy) showed how time series of FAPAR can be used to monitor land surface changes, presenting a case study of the Sahel region. Satellite data have been used since the early 1990s to monitor land cover or vegetation trends and to derive biophysical parameters. She argued that FAPAR is superior to NDVI (Normalized Difference Vegetation Index) in its characterization of vegetation variability in the semi-arid regions closest to the desert boundary – when there is no vegetation/signal, FAPAR values are close to 0. FAPAR can be used to detect anomalies due to inter-annual variations of climate and is consistently highly correlated with precipitation. In the Sahel region, for example, there is a strong correlation between El Nino and drought/negative anomalies in FAPAR. Some 10 years of FAPAR product have already been processed (<http://fapar.jrc.it/>).

Yves Govaerts (EUMETSAT, Darmstadt, Germany) showed the recorded increase in surface albedo during the Sahel drought based on Meteosat observations (in the visible to near-infrared spectral bands). He estimated the difference in albedo between 1984, the driest year, and 2003, a wetter year, to be 0.09 ± 0.05 , with a 10-15% uncertainty due to errors in retrieval, calibration and spectral conversion – pointing out the importance of the error bar to correctly evaluate the significance of the change in surface albedo. He presented an analysis of the seasonal cycles of precipitation, vegetation (as measured by FAPAR) and surface albedo from which emerged that during the rainy season there is an increase in vegetation and a decrease in surface albedo and vice versa during the dry

season, and that there is a 1-month lag between precipitation and vegetation response. Ten years of surface albedo data are available from <http://archive.eumetsat.org/>.

Achim Roeder (University of Trier, Trier, Germany) presented a local study, of the Lagadas region, near Thessaloniki, Greece, to test the use of temporal and spatial trends to monitor change in the Mediterranean range lands. Land change analysis based on satellite images, indicative of an increase in agricultural use in the study area, was confirmed in situ. In particular, the temporal trend resulted to be partially related to topography (i.e., grazing tends to occur in valleys, not in plains) and the spatial trend confirmed the anthropogenic influence on livestock distribution patterns. He concluded that both spatial and temporal characteristics should be used to analyze land degradation.

Emerging themes:

Reliable, accurate remote sensing products such as surface albedo, FAPAR or aerosol characterizations are now available globally and for periods covering a decade or more. These products are starting to be analyzed to document the trends that may have affected drylands during that period. A host of sociological and economic data has also been accumulated, offering new opportunities to develop meaningful integrated indicators, not only of the state of the environment but also of the living conditions of the local populations.

New developments and novel ideas:

Considerable progress has been achieved in monitoring technologies, especially from space. Modern sensors feature specifications and performances unheard of decades ago, and much research has been invested in developing advanced methods to exploit these data and derive geophysical and environmental products. The current state of science and technology justifies the re-analysis of older databases, and thus to better document the historical evolution of the concerned areas. From a conceptual point of view, syndromes such as high variability, low fertility, sparse populations, remoteness from markets and decision centres, are progressively emerging (for instance through the DDP) to describe the plight of drylands. These may, in the long run and after further refinements, provide a useful framework to address these issues in a truly interdisciplinary way.

Problem areas and unresolved issues:

How are the area and problem of interest defined? Information on socio-economic attributes, e.g., poverty, is collected on spatial and temporal scales very different from typical data acquisition methods in geophysics and environmental science. This implies non-trivial difficulties in merging both types of data, or, more generally, to merge qualitative and quantitative data, and therefore in reaching conclusions about climatic change and social causes of environmental change. Environmental change can be slow and needs to be monitored over long time scales. Remote sensing technologies have only recently started to generate time series of sufficient length (2 to 3 decades) to investigate such changes.

Session 7: Scenarios, mitigation, adaptation and best practices

Chairperson: Anton Imeson

Rapporteur: Joachim Hill

Guest speakers:

Cheikh Mbow (Université Cheikh Anta Diop, Dakar, Sénégal) described the ecological situation in Eastern Saloum, Senegal (in particular the history of groundnut production), and used this example to analyse historical developments and relations between climate, environmental and human processes. He underscored the fact that adaptation is not an option but a necessity, that decoupling the climate factors from other, human-based ones, may be difficult, and that reductions in availability or quality of natural resources leads to exclusion, privatization and social conflicts. The pro-active anticipation of changes may be a key element in forging useful and inclusive development policies.

Jennifer Koch and Rudy Schaldach (University of Kassel, Kassel, Germany) described a research project in Jordan, a region subject to severe water stress and high growth rates of population and economies. Adapting a generic LandSHIFT model to these conditions, they generated scenarios and projections for the period until 2050, looking at the livestock, urban and agricultural sectors and their competition for land. This model, still under development, allows decision makers to evaluate the consequences and implications of particular policies.

Mohamed S. Abdel Razik (University of Alexandria, Alexandria, Egypt) explained the Egyptian contribution to the ROSELT network of the Observatoire du Sahara et du Sahel (OSS) and described the national plan to combat desertification. A comprehensive system of data collection provides the basis to generate information suitable for ingestion in environmental models. These, in turn, can be used to assess current climatic, soil and vegetation resources. He described the current system of classification of desertification status and risk in Egypt and how information is collected and disseminated, and highlighted some of the constraints in effectively combating desertification, including a lack of sufficient understanding of the processes involved, the difficulty of communicating the complexity of science issues to policy makers and the added challenge of conveying the urgency of the problem when local populations and policy makers alike slowly adapt to the degrading situation.

Dorothy Amwata (Observatoire du Sahara et du Sahel, Tunis, Tunisie) provided a detailed comparison of the UN Framework Convention on Climate Change (UNFCCC) and the UN Convention to Combat Desertification (UNCCD). Focusing on the vulnerability of populations at different scales, she underscored the lack of synergy between these two 'Rio Conventions', as well as the lack of joint vulnerability to both climate change and desertification. Issues of cross-cutting vulnerability include freshwater availability, deforestation and biodiversity, health, food, drought and land

degradation. She called for more action to address the problems, both globally and by economic sector.

Emerging themes:

A much more comprehensive and detailed analysis of the different interactions between climate change and desertification, over a range of spatial and temporal scales, is necessary to underpin adaptation strategies and guarantee appropriate and sustainable development over the long run. Advances have been made in understanding the complex causes and processes of desertification, but this knowledge is still fragmented in a web of often poorly connected scientific disciplines.

Adaptation to both climate change and environmental degradation is not an option but a necessity. The most significant as well as the longer lasting results are to be found when and where benefits can accrue both on a short and on a longer time scale. For instance, changes in land use or practices can result in higher productivity as well as a gradual, long term improvements in soil fertility, the sustained provision of ecosystem goods and services, and thus an overall increase in the social and natural capital of the community.

Adaptation and mitigation strategies to climate change and environmental degradation, including desertification, must often be adjusted to account for local constraints and conditions (e.g., particular soils and climates, social conditions, etc). Critical thresholds, local 'traps' and slow variables must be taken into account; more attention should be paid to the integration of local, regional and global models, as well as to the effective use of remote sensing for the identification of indicators that may help diagnose critical conditions and predict likely evolutions.

New developments and novel ideas:

Spatially explicit land use scenario modelling was emphasised as a necessary tool for projecting current situations into future scenarios. Against the background of suitable validation studies, such an approach potentially provides indications for designing adaptation strategies and a systematic analysis of their impact on securing resource availability under future conditions. Besides the optimisation of interconnected modelling components it was emphasised that a specification of scenarios is needed which does not only focus on the climate impact but also considers socio-economic conditions.

Problem areas and unresolved issues:

The design of adaptation strategies should focus more explicitly on developing the potential and specific opportunities of dryland ecosystems. Analysing the vulnerability of societal interfaces is important, but this should be coordinated with a careful exploration of renewable resources. The Dryland Development Paradigm presented in another session of the conference may provide a suitable analytical framework for this task.

Scenario modelling is acknowledged as an important issue in exploring the response of dryland systems with regard to development strategies. At the present stage further methodological and conceptual developments and designing suitable validation strategies are both needed.

Long-term remote sensing data archives that cover different spatial and temporal scales do exist, but standardized observations in drylands remain very heterogeneous. A number of observation networks already exist, efforts should be undertaken to make this information more easily accessible and exchangeable to sustain development programmes. This implies agreeing on standards and a minimum set of essential variables. Suitable IT support structures are available to successfully approach this issue, though data ownership issues remain unresolved.

Session 8: Workshop conclusions and recommendations

Chairperson: Bob Scholes

Chairperson: Mary Seely

The last session of the workshop was organized around five parallel working groups which later reported their findings to the plenary session:

- WG1 addressed the Science-Policy Process and compiled a draft letter to the Chair of IPCC and Secretary of the UNCCD supporting and expanding on the idea of a Special Report on Climate Change, Climate Variability and Drylands. See the 'Outcomes' section below for more details.
- Participants in WG2 addressed the need for a dryland observation system and will draft a concept for the Technical Design Workshop of European Desert Net who will meet in early 2008.
- WG3 discussed options for synthesis papers from this workshop and started developing draft outlines for circulation to gather suggested contributions from potential authors.
- The publication of workshop proceedings in the form of a book or as a dedicated issue of an appropriate journal was discussed by WG4. See the 'Outcomes' section below for more details.
- WG5 discussed possible networks and research proposals. No new network was recommended but participants are invited to join existing networks and efforts, such as the AMMA or the A-AARNET networks (refer to Cheikh Mbow and Jean Ndikumana, on the participants list, for further information). This WG suggested that participants could include analytical comments on existing data sets to facilitate their use by others. The working group session concluded with the offer from Michel Verstraete to set up an e-mail list server and to continue the workshop website as a point of contact.

The following **conclusions** emerged from this workshop:

- There is a renewed interest in the possibility that a large fraction of the observed variability of land vegetation properties and of the observed land degradation may be a direct response of ecosystems to slow climatic fluctuations. More attention

- should be given to understand these teleconnections, especially with a view to predict such multi-annual fluctuations, in particular to adapt development strategies or take advantage of them for recovery actions.
- Observational records in drylands are often discontinuous or incomplete, both in space and time. This may be due to the logistic difficulties of installing and maintaining equipment in remote areas, but also to lack of funding, data losses through disasters and war, poor or inaccessible archival in national institutions, scattered data bases with older records held in institutions of former colonial powers, for instance. Unclear or inappropriate data ownership and access rights may further limit access to these records, even for scientific purposes. In many cases, an analysis of proxy records (e.g., paleoclimatology) and of global remote sensing databases represents the best (if not the only) opportunity to reconstruct the past evolution of the climate and the environment.
 - A number of cross-cutting issues came up repeatedly during the workshop, including
 - the need to better understand the interactions between climate variability, environmental vulnerability and human activities on a wide range of space and time scales,
 - the necessity to address these issues from a truly integrated, interdisciplinary perspective,
 - the relevance of Local Environmental Knowledge (LEK) to shape meaningful development strategies and ensure acceptance and proper implementation, and
 - the critical need to communicate scientific findings, and in particular the degree of uncertainty, to policy makers and development planners, in a way that is readily understood and usable.

It is not possible to provide an exhaustive coverage of all relevant issues of such a broad field in a 3-day workshop. Some issues were only briefly discussed (e.g., soil erosion or dust mobilization, transport and deposition, or the connections between desertification and the energy sector, as exemplified by the charcoal production), while others were deemed outside the scope of this meeting from the outset (e.g., practical measures for adaptation and mitigation, or the financial arrangements required to implement such measures). Nevertheless, the participants suggest the following **recommendations on research priorities** would significantly advance the state of our understanding and thus result in a better overall support to the needed policies:

- Further progress in state of the art research in a number of disciplines remains at the core of the scientific enterprise and should continue to be supported.
- Nevertheless, the greatest advances in understanding and in generating directly exploitable knowledge are to be found in integrated, interdisciplinary research, particularly when dedicated efforts are made to enhance communications and collaborations between the natural and human sciences. The Dryland Development Paradigm (DDP) constitutes an initial step in this direction.
- Conceptual and mechanistic integrated models of the climate, environment and human aspects of dryland development, operating over a range of spatial and temporal scales, are important tools to formalize our understanding of the

- processes involved and to generate future scenarios and projections. These models should be further refined, evaluated, integrated and nested, and special efforts are needed to render some of these tools available and usable by extension officers in the field or by scientists involved with local communities.
- The specificity and complexity of the issues at hand, and the current severe limitations of data gathering activities, may justify the creation of a **Global Drylands Observing System (GDOS)** to organize and harmonize data acquisition and analysis in these regions. Such a system would complement existing efforts in the climate area (e.g., the Global Climate Observing System) and coordinate with the Committee on Earth Observation Satellites (CEOS), and should address the following issues, amongst others:
 - the identification of a small number of essential variables, describing relevant aspects of the climate, environment and human issues, and most relevant to understand the processes at work,
 - the development, validation and deployment of standardized tools and algorithms to generate coherent, homogeneous, global, long-term characterization of the state and evolution of the environment on the basis of remote sensing data in a way suitable for ingestion into models or use in practical applications, and the subsequent reprocessing of entire satellite data archives,
 - the standardization of measurement as well as the data exchange protocols, so as to make these observations compatible and comparable,
 - the calibration of the sensors and validation of the products through benchmarking, to ensure their reliability and document their accuracy,
 - the clarification of data ownership issues, and the promotion of more open access policies for scientific purposes, and
 - the improvement of the spatial coverage and temporal continuity of data collection activities, not only in the natural but also in the human sciences.

Additional efforts are also needed to promote better (two-way) **communications between the major stakeholders**, in particular the scientific, policy making and development communities. This may require establishing 'boundary organizations' to facilitate (translate) jargon and language between all concerned stakeholders. These efforts should aim at improving, in particular, the support of the scientific community to the Conference of the Parties (COP) to the UN Convention to Combat Desertification (UNCCD), which should avail itself of a strong advisory body of independent scientists capable of providing the understanding necessary to meaningfully address these issues, as is the case for the UN Framework Convention on Climate Change.

Poster session

Haroun Abdallah: Drought and Climate Change in the Sudan

Amin Al Amin: Impact Of Climate Change On Grazing Reserves Of The Drylands Of Nigeria

Andreas Brink: 25 years of land cover change in Sub-Saharan Africa – A driver of land degradation?

Wadid Erian, B, Katlan and S, Ibrahim: ACSAD Regional Role in Land Degradation Monitoring, Land Degradation in Arab Region

Ulf Helldén, Christian Tottrup: Desertification-A global monitoring approach

Linda Hunt, Michel M. Verstraete: Exploring the feasibility of monitoring desertification processes using MISR products

Maud Loireau: Climate-societies-environment integrated system for a best natural resources management, case of application in the network of Roselt/OSS observatories within the context of combating desertification

Hong Ma: Study on the technology of forestry ecology projects monitoring, and "3S" technology integration - case studies in the Inner Mongolia Region of China

Domagoj Mihajlovic: The analysis of the meteorological droughts in Croatia

Claas Olehowski, Alexander Siegmund: Vulnerability- and Feasibility analysis of semiarid Island ecosystem in the marginal tropics on the example of Fogo (Cape Verde Islands). A study based on Remote Sensing and GIS

A. Röder, J. Hill, G. Tsiourlis: Scale transitions in leaf area index estimation. What are we actually measuring?

Stefan Sommer, H. Billing, U. Hellden, J. Hill, D. Koslowsky, M. Stellmes, C. Weissteiner: Regional trends and pulses of physical surface characteristics and land use changes derived from satellite data time series as indicator of desertification

Andy Spiess: Developing Adaptive Capacity for Responding to Desertification and Climate Change in the GCC: Uncertainties and Constrains to linking Ecosystem Conservation, Sustainable Development and Society in Authoritarian Rentier Economies

M. Stellmes, T. Udelhoven, A. Röder and J. Hill: Land degradation monitoring at local and regional scale: comparison of Landsat TM and NOAA AVHRR time series

Anton Vrieling, Oscar Rojas: NDVI and rainfall trend analysis for the Horn of Africa

Outcomes of this workshop

- The participants in the Wengen workshop mandated Michel M. Verstraete to send a **letter to Rajendra K. Pachauri**, Chairman of the Intergovernmental Panel on Climate Change (IPCC) and to Grégoire de Kalbermatten, Officer-in-Charge at the Secretariat of the UNCCD. This letter is in support of the suggestion by The International Forum on Soil Science and Society, which met at Selfoss, Iceland, from 31 August to 4 September 2007, to issue an IPCC Special Report on Climate Change and Desertification. A copy of this letter, sent on 19 September 2007 is attached below (Annex 3). Grégoire de Kalbermatten acknowledged the receipt of this letter the same day and appreciated the timeliness of this initiative (Annex 4).
- The participants also noted the lack of progress in the implementation of the UNCCD, despite years of investment in the support of National Plans of Action to combat desertification. One of the issues that have been identified is the almost complete disconnect that has emerged years ago and is continuing today between the debates within political arenas and the achievements made by the scientific community. Major donors in general and the European Commission in particular are eager to promote renewed efforts to base future policies and implementation plans on a much stronger scientific basis. As indicated earlier in this report, the UNCCD COP should avail itself of a **scientific structure** capable of delivering credible support in terms of understanding and forecasting capabilities, on par with the achievements of the IPCC in the context of UNFCCC. This should include both a revamped intellectual framework to better apprehend the relevant issues and a coordinated, integrated **system to observe** the state and evolution of the regions concerned (GDOS).

An **ftp site** and an **email list server** have been set up to facilitate communications between the participants in the Wengen workshop. This simple, non-intrusive mechanism has already permitted the distribution of various documents, including the presentations of the lecturers, the letter to IPCC and the reply from UNCCD mentioned above, as well as a draft version of this report. In the future, this system will allow participants to share announcements for calls for proposals, special issues of professional journals, or opportunities for collaborations and field campaigns, for instance.

Last but not least, workshop participants are expected to contribute scientific papers to be published in the professional refereed literature. Various options have been considered as possible outlets for the formal **proceedings** of this workshop, including the publication of a book, assembling a special issue of an appropriate journal, and the submission of a few synthesis papers in high-visibility journals.

Annex 1: Workshop agenda

Sunday 9 September

15:00-18:00 Registration

Monday 10 September

08:00-09:00 Registration

09:00-09:30 Introduction and welcome, Michel Verstraete and Martin Beniston

Session 1: Desertification: The policy context

Chair: Michel Verstraete

Rapporteur: Stefan Sommer

09:30-09:45 Climate and Desertification: Partnering in Research

Ann Henderson-Sellers, WCRP

09:45-10:00 Environment-Development Imperatives for Climate Change and Desertification

Gemma Shepherd, UNEP

10:00-10:15 GEOSS – To better cope with Environmental Change?

Alexia Massacand, GEO Secretariat

10:15-10:30 GMES: Towards a European Earth Observation Capacity providing Information Services

Virginia Puzzolo, GMES Bureau

10:30-11:00 Coffee break

Session 2: Desertification: The World's most desperate environmental problem?

Chair: Osvaldo Sala

Rapporteur: Eric Lambin

11:00-11:30 Desertification in Southern Africa

Bob Scholes, CSIR

11:30-12:00 The "Dryland Development Paradigm" – Seeking necessary but sufficient complexity in desertification analyses

Mark Stafford-Smith, CSIRO

12:00-12:30 Session discussion

12:30-14:00 Lunch

Session 3: Desertification: Complex interactions between people, climate and the land

Chair: Mary Seely

Rapporteur: Alexia Massacand

14:00-14:30 Coupled Human-Environment System Approaches to Desertification

- Eric Lambin, with Hugues Lorent for the case study, UCL
 14:30-15:00 Regeneration and degeneration: Rangeland condition in post-socialist Central Asia
 Roy Behnke and Mike Coughenour, Odessa Centre
- 15:00-16:00 Coffee break and poster session
- 16:00-16:30 Spatial and temporal controls of carbon cycling in arid ecosystems
 Osvaldo Sala, Brown University
- 16:30-17:00 Desertification in China: Problems with Policies and Perceptions
 Hong Jiang, University of Hawaii
- 17:00-17:30 Using an integrated assessment framework with respect to climate change: an example of wheat potential in Africa under CC Scenarios
 JungoLiu, Steffen Fritz, Erwin Schmid, Michael Obersteiner, Uwe Schneider and Lia van Wesenbeeck, EAWAG and IIASA
- 17:30-18:00 Session discussion

Tuesday 11 September

Session 4: Climate drivers of change in dry lands

Chair: Ann Henderson-Sellers

Rapporteur: Nadine Gobron

- 09:00-09:30 Interannual to multicentury variability in arid region hydroclimate
 Malcolm K. Hughes and Henry F. Diaz, University of Arizona and NOAA
- 09:30-10:00 Regional climate models and applications to desertification
 Martin Beniston, University of Geneva
- 10:00-11:00 Coffee break and poster session
- 11:00-11:30 Can we use ENSO climatic events to combat desertification?
 Milena Holmgren, Wageningen University
- 11:30-12:00 The impact of climate change on desertification
 Anton Imeson, University of Amsterdam
- 12:00-13:30 Lunch
- 13:30-14:00 Climate change in the African Sahel
 Alessandra Giannini, IRI
- 14:00-14:30 Managing Climate Variability and its Impacts on Key Climate-Sensitive Sectors in Sub-Saharan Africa: the Experience from IRI
 Pietro Ceccato, Michael Bell, Stephen Connor, Alessandra Giannini, Judy Omumbo and Madeleine Thomson, IRI
- 14:30-15:00 Session discussion
- 15:00-16:00 Coffee break and poster session

Session 5: Population drivers of change in dry lands

Chair: Mark Stafford-Smith

Rapporteur: Andreas Brink

- 16:00-16:30 Advances in desertification and climate change research: Are they accessible for application?
Mary Seely, DRFN
- 16:30-17:00 LU-CDM, A Conceptual Model of Desertification
Ulf Helldén, Lund University
- 17:00-17:30 Desertification in Somalia: Is it Human Induced? Can it be Monitored?
Ali Ismail and Simon Mumuli Oduori, FAO/SWALIM
- 17:30-18:00 Session discussion

Wednesday 12 September

Session 6: Monitoring changes in dry lands

Chair: Alessandra Giannini

Rapporteur: Virginia Puzzolo

- 09:00-09:30 Imaging Desertification Syndromes from Space – Regional Assessment and Monitoring Strategies for a Global Problem
Joachim Hill, Marion Stellmes, Thomas Udelhoven, Stefan Sommer and Achim Röder, University of Trier, CRPG and JRC
- 09:30-10:00 Potential of long times series of FAPAR products for assessing and monitoring land surfaces changes
Nadine Gobron, JRC/IES
- 10:00-11:00 Coffee break and poster session
- 11:00-11:30 Estimation of Surface Albedo Increase During the Eighties Sahel Drought from Meteosat Observations
Yves Govaerts and Alessio Lattanzio, EUMETSAT and Makalumedia
- 11:30-12:00 Temporal vs. spatial trend analysis in monitoring rangeland degradation. A matter of perspective?
Achim Röder, J. Hill, T. Kümmerle, G. del Barrio, V. Papanastasis and G. Tsiourlis, University of Trier, Humboldt University, EEZA, Aristotle University and NAGREF
- 12:00-12:30 Session discussion
- 12:30-14:00 Lunch

Session 7: Scenarios, mitigation, adaptation and best practices

Chair: Anton Imeson

Rapporteur: Joachim Hill

- 14:00-14:30 Environmental changes and local adaptation strategies in Eastern Saloum (Senegal)
Cheikh Mbow, Awa Diouf Sylla, Ole Mertz, Anette Reenberg, Kjeld

- Rasmussen, ISE-LERG/UCAD/ and DGGUC
- 14:30-15:00 Estimating the Effects of Overgrazing on Land Use Change for the Jordan River Region
Jennifer Koch and Rudy Schaldach, CESR
- 15:00-16:00 Coffee break and poster session
- 16:00-16:30 Combating desertification, from monitoring to decision making, what are the odds? An implication from arid south
Mohamed S. Abdel Razik, University of Alexandria
- 16:30-17:00 Vulnerability approach to Desertification and Climate change in Africa
Dorothy Amwata, OSS
- 17:00-17:30 Session discussion

Thursday 13 September

Session 8: Workshop conclusions

Chair: Bob Scholes

Rapporteur: Mary Seely

- 09:00-12:30 Synthesis, recommendations, outcome (publications)
- 12:30-14:00 Lunch
- 14:00-19:00 Excursion to the Jungfraujoch

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**Group picture of the participants in the Wengen workshop on
Climate Change and Desertification**



Annex 3: Letter to IPCC, with copy to UNCCD Secretariat

Ispra, December 3, 2007

H03-GEM(2007)D/21576

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RE: Proposed IPCC Special Report on Climate Change and Desertification

A recommendation to compile an IPCC Special Report on Climate Change and Desertification was made earlier this month by “The International Forum on Soil Science and Society” which was organized at Selfoss, Iceland, by the Icelandic Soil Conservation Service under the Patronage of the President of Iceland, Ólafur Ragnar Grímsson. This recommendation was supported by representatives of many international organizations and an extended summary report on the findings of the Working Groups of that meeting can be downloaded from the Internet at <http://www.iisd.ca/download/pdf/sd/ymbvol144num1e.pdf>.

An IPCC Special Report on Climate Change and Desertification is urgently needed. The results of our recent meeting, the workshop on 'Climate Change and Desertification: Monitoring, modelling and forecasting', held in Wengen, Switzerland, from 10 to 13 September 2007 (<http://www.unige.ch/climate/Workshops/wengen07.html>), demonstrated that scientific knowledge about desertification and climate change is scattered in the literature of many disciplines and that there is an urgent need to establish a policy-relevant scientific assessment. The results of our meeting also highlighted that the processes and implications of desertification are of great and widespread concern, as well as affecting particularly the poorer segments of the global population.

The most recent IPCC predictions indicate that dryland areas may be expanding. Although research related to desertification is on-going, recent results have underscored a number of challenges to policy and a lack of a consolidated intellectual understanding of the underlying causes and effects. The development of a special report and a better integration between climate change and desertification research results would establish synergy and provide a unique opportunity to examine future impacts of climate change. The rate of climate change predicted by IPCC echoes the rate of environmental change in the Sahel experienced in the past three or four decades, providing a test case of how humans have had to respond. Adaptation has already occurred to some extent in the Sahel, while massive dislocations and adjustments have taken place in central Asia after the collapse of the Soviet Union and associated institutions. Areas facing the risk of reduced precipitations in the future, and drylands in particular, host numerous inhabitants who may not have been severely affected yet, and thus may not have built the necessary expertise or conducted sufficient preparatory actions. These examples provide opportunities to examine, inter alia, the relationship between science and policy under predicted climate change.

Our meeting has also highlighted the relationships between climate change and desertification processes, which include many feedbacks at different scales so that both global and local assessments and accessible data sets are needed. It is particularly urgent to consider vulnerability as well as food and environmental security. Tackling desertification by means of ecosystem restoration and sustainable land management can positively influence micro and meso-climates, as well as the land surface energy and moisture budgets. Last but not least, sustainable land management and ecosystem restoration can and is being used to sequester carbon.

Participants in the above-mentioned Wengen-2007 Workshop on Climate Change and Desertification strongly support the recommendation for IPCC to issue a Special Report on Climate Change and Desertification.

We look forward to your favourable response,

Michel M. Verstraete
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EC Joint Research Centre
Via Enrico Fermi, 1
I-21020 Ispra (VA), Italy

cc: Guido Schmuck, Alan Belward, Frank Raes, Mark Dowell, Philippe Mayaux, Luca Montanarella

Annex 4: Reply from UNCCD to the letter to IPCC

The following email message was received from Grégoire De Kalbermatten, Secretariat of the UNCCD, in response to the letter shown in Annex 3, on the same day that letter was sent.

dear Mr Verstraete,

Thank you for these lines. We do appreciate the timeliness of your initiative. As a matter of fact, I regret the Wengen meeting took place during the COP as, perhaps, it would be helpful if, in the future, we can join such events where matters so germane to the core concerns of the Parties to the UNCCD are being discussed.

The Secretariat of the UNCCD is behind the conclusions of the Selfoss meeting and confirms that the latest COP 8 in Madrid heard many calls for more synergistic cooperation between the three Rio Convention processes. During the last session of the Committee on Science and Technology (CST) the relationship between climate change and desertification was debated as one of the priority issues tabled before the Committee.

Calls for increased cooperation include of course the area of assessment and monitoring and an IPCC Special Report on Climate Change and Desertification would be most welcome to strengthen the scientific perspective and the information to back up the decision making.

I can thus kindly confirm to dr Pachauri by copy of this exchange that the proposal receives our full support. It would be desirable of course that such an exercise would be convened in an inclusive manner, associating scientists that are involved in the UNCCD process.

Best regards, Grégoire de Kalbermatten

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